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THE ABSENCE OF NICKEL ISOTOPIC ANOMALY IN IRON METEORITE METAL AND SULFIDE

J. H. Chen[1], D. A. Papanastassiou[2], and G. J. Wasserburg[3]. [1]Science Division, M/S 183-601, Jet Propulsion Laboratory, Pasadena, CA 91109–8099, USA. [2]Science Division, M/S 183-335, Jet Propulsion Laboratory, Pasadena, CA 91109–8099, USA. [3]The Lunatic Asylum, GPS Div., 170-25, Caltech, Pasadena, CA 91125, USA.

Introduction: Evidence for ^{60}Fe ($\tau^{1/2}$ = 1.5 Ma) has been reported in eucrites and chondrites [1–4], consisting of excesses in ^{60}Ni, in phases with high Fe/Ni. Recent work on iron meteorites, using MC-ICP-MS, indicates a complex picture. Quitté et al. [5] analyzed FeNi and sulfide from iron meteorites and found no ^{60}Ni effects in the FeNi at ±0.3 εu. However, in some sulfides, they found large and correlated effects in ε^{60}Ni and ε^{61}Ni. In irons, Bizzarro et al. [6] claimed small shifts in ^{60}Ni and ^{62}Ni. Cook et al. [7] showed shifts of −0.5 εu in ^{60}Ni in several sulfides and up to −2.4 εu in Mundrabilla sulfide.

In this study, using TIMS, we determined that, for samples of FeNi from 6 iron meteorites of different groups (Bennett County, Bella Roca, Gibeon, Piñon, Odessa, and Mundrabilla), the ε^{60}Ni are the same as terrestrial normal to within ±0.1 εu and ε^{61}Ni are normal to ±0.5 εu. For the observed ^{56}Fe/^{58}Ni in FeNi as low as 7 and $(^{60}\mathrm{Fe}/^{56}\mathrm{Fe})_0 < 2.4 \times 10^{-7}$, we would expect a deficit in ^{60}Ni of −0.1 εu, which is not resolvable. The preliminary Ni data [8] on sulfide samples have larger uncertainties, due to low Ni concentrations and possibly some residual mass interference problems (CaF ions). After further purification, the Ni data on sulfide samples from Odessa, Toluca, and Mundrabilla (Fig. 1) show normal Ni isotopic ratios within limits of errors. We do not confirm deficits in ^{60}Ni in sulfides in Mundrabilla or other iron meteorites. The data show no evidence for ^{60}Ni excesses and yield limits on ^{60}Fe/^{56}Fe of $<2 \times 10^{-9}$.

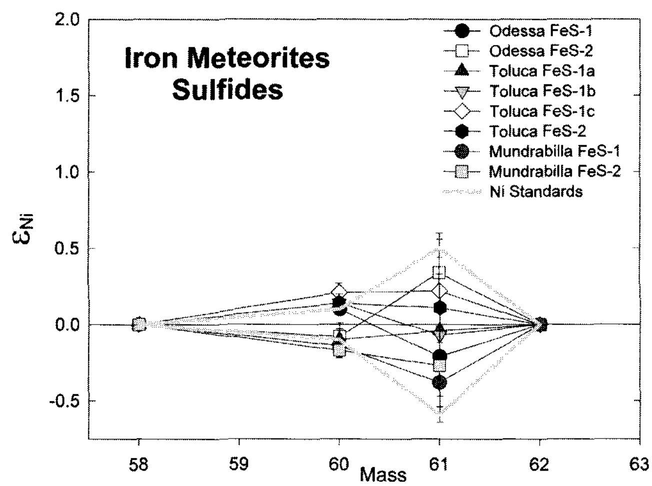

Fig. 1.

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References: [1] Shukolyukov A. and Lugmair G. W. 1993a. *Earth and Planetary Science Letters* 119:159. [2] Shukolyukov A. and Lugmair G. W. 1993b. *Science* 259:1138. [3] Tachibana S. and Huss G. R. 2003. *The Astrophysical Journal* 588:L41. [4] Mostefaoui S. et al. 2004. *New Astronomy Reviews* 48:155. [5] Quitté G. et al. 2006. *Earth and Planetary Science Letters* 242:16. [6] Bizzarro M., Ulfbeck D., and Thrane K. 2006. Abstract #2020. 37th LPSC. [7] Cook et al. 2007. Abstract #2287. 38th LPSC. [8] Chen J. H., Papanastassiou D. A., and Wasserburg G. J. 2007. Abstract #1753. 38th LPSC.

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THE ASSEMBLAGE NATIVE COPPER, COBALTIAN KAMACITE, AND TROILITE IN ORDINARY CHONDRITES: DISSOCIATION PRODUCTS NOT RELATED TO A SHOCK EVENT

H. Chennaoui Aoudjehane[1], A. El Goresy[2], and A. Jambon[3]. [1]Université Hassan II Aïn Chock, Laboratoire Géosciences, BP 5366 Maârif Casablanca, Morocco. E-mail: h.chennaoui@fsac.ac.ma. [2]Bayerisches Geoinstitut, Universität Bayreuth, 95447 Bayreuth, Germany. [3]Université Pierre et Marie Curie-Paris6 Laboratoire MAGIE, Case 110, France. [4]Place Jussieu, 75252 Paris, France.

Introduction: Native Cu in chondritic meteorites is an abundant accessory phase associated with troilite and metal. Ramdohr [1, 2] interpreted its occurrence is the result of exsolution from taenite during cooling. In a recent report, [3] claimed metallic Cu to have formed by shock. No evidence was presented supporting the shock origin nor a chemical mass balance to explain the association of metallic copper with troilite symplectites. We investigated this assemblage in the LL6 chondrite Benguerir to clarify the origin of the assemblage.

Results: SEM and quantitative electron microprobe analyses conducted on the four-phase assemblage, native Cu + troilite + kamacite + taenite, revealed chemical compositions that cannot be produced by exsolution from taenite during a shock event. The native copper grains enclosed in FeNi are usually surrounded by a Ni-poor but Co-rich kamacite. In Usti Nad Orlici the Ni-poor kamacite contains up to 1.77 wt% Co. No depletion in the adjacent taenite was detected in profiles across taenite-kamacite-copper thus negating formation of both native Cu and cobaltian kamacite by exsolution from taenite. In the LL6 chondrite Benguerir a similar assemblage was encountered. The cobaltian kamacite surrounding the Cu grains were found to be enormously enriched in Co (up to 14.3 wt%) and depleted in Ni. This cannot be explained by exsolution from taenite during cooling nor by a shock-induced heat event. The symplectitic texture of FeS, the unusual enrichment of the kamacite engulfing the native Cu specks in Co, and the lack of Ni diffusion profiles in the neighboring taenite strongly suggests formation of the assemblage through breakdown of a meta-stable complex sulfide species containing Fe, Cu, and Co as major constituents. We envisage a pentlandite-type mineral as a precursor that broke down to this assemblage according to the idealized reaction:

$$(\mathrm{Fe}_{0.833}\mathrm{Co}_{0.33}\mathrm{Cu}_{0.33})_9\mathrm{S}_8 \rightarrow 8\mathrm{FeS} + 0.33\mathrm{Cu} + 0.66(\mathrm{FeCo})$$

Both meteorites belong to the shock stage S2 [4] and no evidence for melting veins or pockets, no recrystallization of troilite and no maskelynite. Furthermore, both troilite and ilmenite grains encountered depict twin lamellae // (10-21) and (10-11) respectively, indicating formation at $P <$ 2 GPa and low post-shock temperature (<200 °C).

Conclusions: This assemblage did not form by exsolution from taenite by shock but rather through decomposition of a meta-stable complex sulfide during low-temperature cooling in the parent body.

References: [1] Ramdohr P. 1963. *Journal of Geophysical Research* 68:2011–2036. [2] Ramdohr P. 1973. *The opaque minerals in stony meteorites*. Elsevier. p. 244. [3] Rubin A. E. 1994. *Meteoritics & Planetary Science* 29:93–98. [4] El Goresy A. 2006. *Meteoritics & Planetary Science* 41:A204.